

AMENDMENTS TO THE CLAIMS

82
Q1. (Currently amended) Simulation process of a radiofrequency scenario starting from generation of serial messages including useful information (SIM_D, BT_SIM, SIM_DEL) for obtaining a phase-modulated radiofrequency test signal comprehensive of the most relevant channel impairments, including co-channel interference, which is sent to the input of a receiver under test (DUT) whose output is monitored, the process comprising ~~characterized in that includes~~ the following ~~further~~ phases piloted by the message contents:

- execution of $N \times P$ digital modulation of a base band carrier, for obtaining P groups (carrier 1, ..., carrier M) of N base band isofrequential digital replicas of said phase-modulated carrier, ~~being~~ P being chosen from 1 to the maximum number M of modulated carriers fitting an ~~the~~ assigned band of the receiver under test (DUT), and N being the number of independent inputs of said receiver;
- digital multiplication, for every P groups of N replicas, of each base band replica by a respective complex constant (SIM_BEAM_W1, SIM_BEAM_W2, ..., SIM_BEAM_WN) assigned to the group, ~~being~~ the numerical order of the replicas and the phases of the multiplicative constants both increasing gradually in ~~the~~ successive products, for beamforming each of the P groups of N replicas according to a an its own desired arrival direction of the P groups for simulation to simulate;
- adjustment of the power level of each of the P groups of N replicas;

- Part 1*
- digital multiplication of each beamformed group of N replicas by a relevant digital intermediate frequency carrier (SIM_NCO) which carries out frequency conversion of the group at a respective intermediate frequency, so establishing for each intermediate frequency converted beamformed group (Cl_1, Cl_2, \dots, Cl_N ; ; CM_1, CM_2, \dots, CM_N) a the relative position inside the broad band of the receiver under test;
 - summation of all the P intermediate frequency converted replicas having the same order in each beamformed group, for obtaining N broad band intermediate frequency replicas (IF1, IF2, ..., IFN);
 - analogue conversion of the N broad band intermediate frequency replicas (IF1, IF2, ..., IFN) and filtering broad band the analogue replicas for reconstruction;
 - radiofrequency conversion, amplification and filtering of the reconstructed analogue replicas ~~of the reconstructed analogue replicas, amplifying and filtering they~~ for obtaining N broad band radiofrequency replicas (RF1, RF2, ..., RFN) constituting a single test signal suitable for testing the operation of a directional receiver, preferably one included in a base station of a radiomobile system designed for cooperating with a N-elements directive array;
 - application of the N broad band radiofrequency replicas (RF1, RF2, ..., RFN) directly to N radiofrequency inputs (in1, in2, ..., inN) of the receiver under test (DUT), each radiofrequency input bypassing an associated ~~the~~ antenna.

2. (Currently amended) Simulation process of radiofrequency scenario

according to claim 1, wherein ~~characterized~~ in that the content of said serial messages (SIM_D, SIM_PN, SIM_DEL, SIM_BEAM_W1, ..., SIM_BEAM_WN, SIM_NCO, OL) is read from general tables (TAB.1, TAB.2,, TABK) of parameters and options defining a scenario concerning at least one useful transmission signal and one or more isofrequential interferent signals, having simulated arrival directions generally different from those of said relevant useful signals.

CS Cont.
3. (Currently amended) Simulation process according to claim 2, wherein ~~characterized in that~~ said general tables (TAB.1, TAB.2,, TABK) constitute a sequence of K tables cyclically read.

4. (Currently amended) Simulation process according to claim 3, wherein ~~characterized in that its~~ operative phases of the simulation process form a sequence repeated at time intervals of the same duration, using time by time said messages obtained converting a new general table of said cyclic sequence, thus giving dynamic and recurrent characteristics to said simulated scenario.

5. (Currently amended) Simulation process according to claim 4, wherein ~~characterized in that~~ said equal duration of the time intervals is such that the variation speed of the contents of said messages is similar to the one that can be detected in the corresponding said parameters of a real scenario.

6. (Currently amended) Simulation process according to claim 5, wherein ~~characterized in that~~ said duration is equal to, or lower than 4.61 ms.

7. (Currently amended) Simulation process according to claim 4, wherein ~~characterized in that~~ said general tables (TAB.1, TAB.2,,

TABK) are updated during the testing time, and corresponding updated messages are generated in synchronous mode compared to said sequential time intervals.

8. (Currently amended) Simulation process according to claim 4, further comprising ~~characterized in that it includes~~ an additional acquisition phase of the results of said testing, in asynchronous mode compared to said sequential time intervals.

9. (Currently amended) Simulation process according to claim 2, wherein ~~characterized in that~~ the selection of some of said options of said general tables (TAB.1, TAB.2,, TABK) involves the compilation of relevant sub-tables containing additional parameters to select for the specified option.

10. (Currently amended) Simulation process according to claim 4, wherein ~~characterized in that~~ said carriers are time division multiplexed, and each of said sequential time intervals of the same duration corresponds to a frame time.

11. (Currently amended) Simulation process according to claim 2, wherein ~~characterized in that~~ said general tables (TAB.1, TAB.2,, TABK) ~~include~~ also include parameters that take into account the presence of noise, ~~the~~ a doppler effect due to the speed of ~~the~~ mobiles, and the quick and sudden fading of a received ~~the~~ electromagnetic field ~~received~~, caused by multiple paths destructive interference or by masking by obstacles encountered by mobiles in movement.

12. (Currently amended) Testing system of a radiofrequency receiver, including a control processor (CNTR_PC) for generating serial messages directed to orthogonal modulation and frequency conversion devices

controlled by the content of said messages for generating a phase-modulated radiofrequency test signal comprehensive of the most relevant channel impairments, including co-channel interference which is sent to the input of a receiver under test (DUT) whose output is monitored, the testing system comprising ~~characterized in that it further includes:~~

- Cont.
- N x P digital modulators (GMSK1, GMSK2, ..., GMSKN) of a self-generated base band carrier, for obtaining P groups (carrier 1, ..., carrier M) of N base band isofrequential digital replicas of said phase-modulated carrier, being P being chosen from 1 to the maximum number M of modulated carriers fitting an ~~the~~ assigned band of the receiver under test (DUT), and N being the number of independent inputs of said receiver;
 - N x P first digital multipliers (M1, M2, ..., MN; ...) arranged for multiplying, for every P groups of N replicas, each base band replica by a respective complex constant (SIM_BEAM_W1, SIM_BEAM_W2, ..., SIM_BEAM_WN) assigned to the group, being the numerical order of the replicas and the phases of the multiplicative constants both increasing gradually in ~~the~~ successive products, for beamforming each of the P group of N replicas according to an ~~its own~~ a desired arrival direction of the P groups for simulation ~~to simulate~~;
 - means for adjusting the power level of each of the P groups of N replicas;
 - N x P second digital multipliers (MM1, MM2, ..., MMN; ...) for multiplying each beamformed group of N replicas by a relevant digital intermediate frequency carrier (SIM_NCO, ...) which

carries out frequency conversion of the group at a respective intermediate frequency, so establishing for each intermediate frequency converted beamformed group ($Cl_1, Cl_2, \dots, Cl_N; \dots; CM_1, CM_2, \dots, CM_N$) a the relative position inside the broad band of the receiver under test;

- CM
C₁ C₂ C₃ C₄ C₅ C₆ C₇ C₈ C₉ C₁₀ C₁₁ C₁₂ C₁₃ C₁₄ C₁₅ C₁₆ C₁₇ C₁₈ C₁₉ C₂₀ C₂₁ C₂₂ C₂₃ C₂₄ C₂₅ C₂₆ C₂₇ C₂₈ C₂₉ C₃₀ C₃₁ C₃₂ C₃₃ C₃₄ C₃₅ C₃₆ C₃₇ C₃₈ C₃₉ C₄₀ C₄₁ C₄₂ C₄₃ C₄₄ C₄₅ C₄₆ C₄₇ C₄₈ C₄₉ C₅₀ C₅₁ C₅₂ C₅₃ C₅₄ C₅₅ C₅₆ C₅₇ C₅₈ C₅₉ C₆₀ C₆₁ C₆₂ C₆₃ C₆₄ C₆₅ C₆₆ C₆₇ C₆₈ C₆₉ C₇₀ C₇₁ C₇₂ C₇₃ C₇₄ C₇₅ C₇₆ C₇₇ C₇₈ C₇₉ C₈₀ C₈₁ C₈₂ C₈₃ C₈₄ C₈₅ C₈₆ C₈₇ C₈₈ C₈₉ C₉₀ C₉₁ C₉₂ C₉₃ C₉₄ C₉₅ C₉₆ C₉₇ C₉₈ C₉₉ C₁₀₀ C₁₀₁ C₁₀₂ C₁₀₃ C₁₀₄ C₁₀₅ C₁₀₆ C₁₀₇ C₁₀₈ C₁₀₉ C₁₁₀ C₁₁₁ C₁₁₂ C₁₁₃ C₁₁₄ C₁₁₅ C₁₁₆ C₁₁₇ C₁₁₈ C₁₁₉ C₁₂₀ C₁₂₁ C₁₂₂ C₁₂₃ C₁₂₄ C₁₂₅ C₁₂₆ C₁₂₇ C₁₂₈ C₁₂₉ C₁₃₀ C₁₃₁ C₁₃₂ C₁₃₃ C₁₃₄ C₁₃₅ C₁₃₆ C₁₃₇ C₁₃₈ C₁₃₉ C₁₄₀ C₁₄₁ C₁₄₂ C₁₄₃ C₁₄₄ C₁₄₅ C₁₄₆ C₁₄₇ C₁₄₈ C₁₄₉ C₁₅₀ C₁₅₁ C₁₅₂ C₁₅₃ C₁₅₄ C₁₅₅ C₁₅₆ C₁₅₇ C₁₅₈ C₁₅₉ C₁₆₀ C₁₆₁ C₁₆₂ C₁₆₃ C₁₆₄ C₁₆₅ C₁₆₆ C₁₆₇ C₁₆₈ C₁₆₉ C₁₇₀ C₁₇₁ C₁₇₂ C₁₇₃ C₁₇₄ C₁₇₅ C₁₇₆ C₁₇₇ C₁₇₈ C₁₇₉ C₁₈₀ C₁₈₁ C₁₈₂ C₁₈₃ C₁₈₄ C₁₈₅ C₁₈₆ C₁₈₇ C₁₈₈ C₁₈₉ C₁₉₀ C₁₉₁ C₁₉₂ C₁₉₃ C₁₉₄ C₁₉₅ C₁₉₆ C₁₉₇ C₁₉₈ C₁₉₉ C₂₀₀ C₂₀₁ C₂₀₂ C₂₀₃ C₂₀₄ C₂₀₅ C₂₀₆ C₂₀₇ C₂₀₈ C₂₀₉ C₂₁₀ C₂₁₁ C₂₁₂ C₂₁₃ C₂₁₄ C₂₁₅ C₂₁₆ C₂₁₇ C₂₁₈ C₂₁₉ C₂₂₀ C₂₂₁ 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C₈₂₂ C₈₂₃ C₈₂₄ C₈₂₅ C₈₂₆ C₈₂₇ C₈₂₈ C₈₂₉ C₈₃₀ C₈₃₁ C₈₃₂ C₈₃₃ C₈₃₄ C₈₃₅ C₈₃₆ C₈₃₇ C₈₃₈ C₈₃₉ C₈₄₀ C₈₄₁ C₈₄₂ C₈₄₃ C₈₄₄ C₈₄₅ C₈₄₆ C₈₄₇ C₈₄₈ C₈₄₉ C₈₅₀ C₈₅₁ C₈₅₂ C₈₅₃ C₈₅₄ C₈₅₅ C₈₅₆ C₈₅₇ C₈₅₈ C₈₅₉ C₈₆₀ C₈₆₁ C₈₆₂ C₈₆₃ C₈₆₄ C₈₆₅ C₈₆₆ C₈₆₇ C₈₆₈ C₈₆₉ C₈₇₀ C₈₇₁ C₈₇₂ C₈₇₃ C₈₇₄ C₈₇₅ C₈₇₆ C₈₇₇ C₈₇₈ C₈₇₉ C₈₈₀ C₈₈₁ C₈₈₂ C₈₈₃ C₈₈₄ C₈₈₅ C₈₈₆ C₈₈₇ C₈₈₈ C₈₈₉ C₈₉₀ C₈₉₁ C₈₉₂ C₈₉₃ C₈₉₄ C₈₉₅ C₈₉₆ C₈₉₇ C₈₉₈ C₈₉₉ C₉₀₀ C₉₀₁ C₉₀₂ C₉₀₃ C₉₀₄ C₉₀₅ C₉₀₆ C₉₀₇ C₉₀₈ C₉₀₉ C₉₁₀ C₉₁₁ C₉₁₂ C₉₁₃ C₉₁₄ C₉₁₅ C₉₁₆ C₉₁₇ C₉₁₈ C₉₁₉ C₉₂₀ C₉₂₁ C₉₂₂ C₉₂₃ C₉₂₄ C₉₂₅ C₉₂₆ C₉₂₇ C₉₂₈ C₉₂₉ C₉₃₀ C₉₃₁ C₉₃₂ C₉₃₃ C₉₃₄ C₉₃₅ C₉₃₆ C₉₃₇ C₉₃₈ C₉₃₉ C₉₄₀ C₉₄₁ C₉₄₂ C₉₄₃ C₉₄₄ C₉₄₅ C₉₄₆ C₉₄₇ C₉₄₈ C₉₄₉ C₉₅₀ C₉₅₁ C₉₅₂ C₉₅₃ C₉₅₄ C₉₅₅ C₉₅₆ C₉₅₇ C₉₅₈ C₉₅₉ C₉₆₀ C₉₆₁ C₉₆₂ C₉₆₃ C₉₆₄ C₉₆₅ C₉₆₆ C₉₆₇ C₉₆₈ C₉₆₉ C₉₇₀ C₉₇₁ C₉₇₂ C₉₇₃ C₉₇₄ C₉₇₅ C₉₇₆ C₉₇₇ C₉₇₈ C₉₇₉ C₉₈₀ C₉₈₁ C₉₈₂ C₉₈₃ C₉₈₄ C₉₈₅ C₉₈₆ C₉₈₇ C₉₈₈ C₉₈₉ C₉₉₀ C₉₉₁ C₉₉₂ C₉₉₃ C₉₉₄ C₉₉₅ C₉₉₆ C₉₉₇ C₉₉₈ C₉₉₉ C₁₀₀₀ C₁₀₀₁ C₁₀₀₂ C₁₀₀₃ C₁₀₀₄ C₁₀₀₅ C₁₀₀₆ C₁₀₀₇ C₁₀₀₈ C₁₀₀₉ C₁₀₁₀ C₁₀₁₁ C₁₀₁₂ C₁₀₁₃ C₁₀₁₄ C₁₀₁₅ C₁₀₁₆ C₁₀₁₇ C₁₀₁₈ C₁₀₁₉ C₁₀₂₀ C₁₀₂₁ C₁₀₂₂ C₁₀₂₃ C₁₀₂₄ C₁₀₂₅ C₁₀₂₆ C₁₀₂₇ C₁₀₂₈ C₁₀₂₉ C₁₀₃₀ C₁₀₃₁ C₁₀₃₂ C₁₀₃₃ C₁₀₃₄ C₁₀₃₅ C₁₀₃₆ C₁₀₃₇ C₁₀₃₈ C₁₀₃₉ C₁₀₄₀ C₁₀₄₁ C₁₀₄₂ C₁₀₄₃ C₁₀₄₄ C₁₀₄₅ C₁₀₄₆ C₁₀₄₇ C₁₀₄₈ C₁₀₄₉ C₁₀₅₀ C₁₀₅₁ C₁₀₅₂ C₁₀₅₃ C₁₀₅₄ C₁₀₅₅ C₁₀₅₆ C₁₀₅₇ C₁₀₅₈ C₁₀₅₉ C₁₀₆₀ C₁₀₆₁ C₁₀₆₂ C₁₀₆₃ C₁₀₆₄ C₁₀₆₅ C₁₀₆₆ C₁₀₆₇ C₁₀₆₈ C₁₀₆₉ C₁₀₇₀ C₁₀₇₁ C₁₀₇₂ C₁₀₇₃ C₁₀₇₄ C₁₀₇₅ C₁₀₇₆ C₁₀₇₇ C₁₀₇₈ C₁₀₇₉ C₁₀₈₀ C₁₀₈₁ C₁₀₈₂ C₁₀₈₃ C₁₀₈₄ C₁₀₈₅ C₁₀₈₆ C₁₀₈₇ C₁₀₈₈ C₁₀₈₉ C₁₀₉₀ C₁₀₉₁ C₁₀₉₂ C₁₀₉₃ C₁₀₉₄ C₁₀₉₅ C₁₀₉₆ C₁₀₉₇ C₁₀₉₈ C₁₀₉₉ C₁₁₀₀ C₁₁₀₁ C₁₁₀₂ C₁₁₀₃ C₁₁₀₄ C₁₁₀₅ C₁₁₀₆ C₁₁₀₇ C₁₁₀₈ C₁₁₀₉ C₁₁₁₀ C₁₁₁₁ C₁₁₁₂ C₁₁₁₃ C₁₁₁₄ C₁₁₁₅ C₁₁₁₆ C₁₁₁₇ C₁₁₁₈ C₁₁₁₉ C₁₁₂₀ C₁₁₂₁ C₁₁₂₂ C₁₁₂₃ C₁₁₂₄ C₁₁₂₅ C₁₁₂₆ C₁₁₂₇ C₁₁₂₈ C₁₁₂₉ C₁₁₃₀ C₁₁₃₁ C₁₁₃₂ C₁₁₃₃ C₁₁₃₄ C₁₁₃₅ C₁₁₃₆ C₁₁₃₇ C₁₁₃₈ C₁₁₃₉ C₁₁₄₀ C₁₁₄₁ C₁₁₄₂ C₁₁₄₃ C₁₁₄₄ C₁₁₄₅ C₁₁₄₆ C₁₁₄₇ C₁₁₄₈ C₁₁₄₉ C₁₁₅₀ C₁₁₅₁ C₁₁₅₂ C₁₁₅₃ C₁₁₅₄ C₁₁₅₅ C₁₁₅₆ C₁₁₅₇ C₁₁₅₈ C₁₁₅₉ C₁₁₆₀ C₁₁₆₁ C₁₁₆₂ C₁₁₆₃ C₁₁₆₄ C₁₁₆₅ C₁₁₆₆ C₁₁₆₇ C₁₁₆₈ C₁₁₆₉ C₁₁₇₀ C₁₁₇₁ C₁₁₇₂ C₁₁₇₃ C₁₁₇₄ C₁₁₇₅ C₁₁₇₆ C₁₁₇₇ C₁₁₇₈ C₁₁₇₉ C₁₁₈₀ C₁₁₈₁ C₁₁₈₂ C₁₁₈₃ C₁₁₈₄ C₁₁₈₅ C₁₁₈₆ C₁₁₈₇ C₁₁₈₈ C₁₁₈₉ C₁₁₉₀ C₁₁₉₁ C₁₁₉₂ C₁₁₉₃ C₁₁₉₄ C₁₁₉₅ C₁₁₉₆ C₁₁₉₇ C₁₁₉₈ C₁₁₉₉ C₁₂₀₀ C₁₂₀₁ C₁₂₀₂ C₁₂₀₃ C₁₂₀₄ C₁₂₀₅ C₁₂₀

- a whole of N coaxial cables, or equivalent means, connecting said N radiofrequency outputs to a same number of inputs (in1, in2, ..., inN) of a said receiver (DUT), without antenna.

13. (Currently amended) Testing system according to claim 12, wherein ~~characterized in that~~ the intermediate frequency converted beamformed groups (C1₁, C1₂, ..., C1_N; ; CM₁, CM₂, ..., CM_N), each of N replicas, are generated by means of P identical digital modules (TX_PROCl, ..., TX_PROCM), each including a dedicated processor interface (INTF_PC) communicating with N digital modulators (GMSK1, GMSK2, ..., GMSKN), N first digital multipliers (M1, M2, ..., MN), and N second digital multipliers (MM1, MM2, ..., MMN); the whole digital modules being connected to N buses (BS1, BS2, ..., BSN) for transferring the N broad band intermediate frequency replicas (IF1, IF2, ..., IFN) towards as many digital to analogue converters (D/A), through a binary tree of N two-inputs digital adders (1, 2, ..., N).

14. (Currently amended) Testing system according to claim 12, wherein ~~characterized in that~~ said control processor (CNTR_PC) transfers to said interface means (INTF_PC, LO_CORP) said control messages (SIM_D, SIM_BEAM_W1, SIM_BEAM_W2,, SIM_BEAM_WN SIM_NCO, OL) at sequential time intervals of identical duration.

15. (Currently amended) Testing system according to claim 14, wherein ~~characterized in that~~ said identical duration of the sequential time intervals is such that the variation speed of the contents of said messages is similar to that which can be detected in corresponding parameters of a real scenario.

16. (Currently amended) Testing system according to claim 12, wherein

~~characterized in that~~ said messages are obtained from the conversion of general tables (TAB.1, TAB.2,, TABK) of parameters and options defining a simulated scenario, stored into said control processor (CNTR_PC).

17. (Currently amended) Testing system according to claim 16, wherein ~~characterized in that~~ said general tables (TAB.1, TAB.2,, TABK) are organized in a sequence of K tables cyclically repeated.

18. (Currently amended) Testing system according to claim 14, wherein ~~characterized in that~~ said duration is equal to or lower than 4.61 ms.

19. (Currently amended) Testing system according to claim 16, wherein ~~characterized in that~~ said general tables (TAB.1, TAB.2,, TABK) are filled in before the testing and updated during the testing, and the corresponding updated messages are generated in synchronous mode compared to said sequential time intervals.

20. (Currently amended) Testing system according to claim 12, wherein ~~characterized in that~~ said carriers are time division multiplexed and said duration corresponds to a frame time.

21. (Currently amended) Testing system according to claim 16, wherein ~~characterized in that~~ said general tables (TAB.1, TAB.2,, TABK) include also parameters to simulate the presence of noise, ~~the~~ a doppler effect due to the speed of ~~the~~ mobiles, and the quick and sudden fadings of ~~the~~ a received electromagnetic field ~~received~~, caused by destructive interference by multiple paths or by masking by obstacles encountered by the mobiles in movement.

22. (New) A method for generating a test signal to be applied to a radiofrequency receiver having N intelligent antennas, comprising the steps of:

obtaining N digital signals, each digital signal replicating a digital multicarrier signal having phase-modulated carriers;

reconstructing N broadband signals by performing digital-to-analog conversion and broadband filtering on the N digital signals;

obtaining N broadband radiofrequency signals by performing radiofrequency conversion on the reconstructed N broadband signals;

amplifying the N broadband radiofrequency signals; and

applying the amplified N broadband to N inputs of the receiver, the N inputs bypassing the N intelligent antennas of the receiver.

23. (New) The method according to claim 22, wherein the obtaining step obtains the N digital signals based on parameters defining a scenario concerning at least one useful transmission signal and one or more isofrequential interferent signals, the isofrequential interferent signals having simulated arrival directions generally different from those of said relevant useful signals.

24. (New) The method according to claim 23, wherein the steps are repeated at time intervals of a same duration, using new parameters to obtain the N digital signals, thus giving dynamic and recurrent characteristics to said simulated scenario.

25. (New) The method according to claim 24, wherein the same duration is substantially equal to, or lower than, 4.61 ms.

26. (New) The method according to claim 23, wherein the parameters take into account the presence of noise, a doppler effect due to the speed of transmitting mobiles, and quick and sudden fading of a received electromagnetic field, caused by multiple paths destructive interference or by masking by obstacles encountered by mobiles in movement.

27. (New) A testing system for a radiofrequency receiver having N intelligent antennas, comprising:

means for obtaining N digital signals, each digital signal replicating a digital multicarrier signal having phase-modulated carriers;

means for performing digital-to-analog conversion on the group of N digital signals;

means for broadband filtering the converted N analog signals to obtain N broadband signals;

means for performing radiofrequency conversion on the N broadband signals to obtain N broadband radiofrequency signals;

means for amplifying the N broadband radiofrequency signals; and

means for transmitting the amplified N broadband radiofrequency signals to N inputs of a radiofrequency receiver, the N inputs bypassing the N intelligent antennas.

28. (New) The testing system according to claim 28, further comprising:

means for obtaining said N digital signals from control messages at sequential intervals of identical duration, said control messages being used to generate a phase-modulated radiofrequency test signal.

29. (New) The testing system according to claim 29, further comprising:

means for storing tables of parameters defining a simulated scenario; and

means for converting said tables of parameters to obtain said control messages.

30. (New) The testing system according to claim 29, wherein the stored tables include,

parameters simulating at least one of: presence of noise, a doppler effect due to speed of mobiles, and fading of a received electromagnetic field.